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by

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SILVICAL CHARACTERISTICS OF FLOWERING DOGWOOD

(Cornus florida L.)

by

John P. Vimmerstedt
Southern Appalachian Research Center

Flowering dogwood (Cornus florida L.) is sometimes called cornel or boxwood (22). Dogwood grows from extreme southwestern Maine west to extreme southern Ontario, southern Michigan, Illinois, and eastern Kansas south to eastern Texas and north-central Florida (fig. 1) (15, 30, 36, 37). The commercial range includes the southern Mississippi Valley, the Southern Appalachian Mountain Region, and most of the southern pine belt (5).

USES

About 90 percent of the dogwood cut is used by the textile industry for shuttleblocks. Minor uses of the wood are for specialty items such as pulleys, jewelers and engravers blocks, mallet heads, and charcoal. The bark, which contains a quinine-like substance, is astringent and high in tannic acid content. Dogwood is widely planted because of its ornamental and game-food values (9, 37).

HABITAT CONDITIONS

CLIMATIC

The amount of annual precipitation within the range of dogwood varies from a low of 30 inches in the north to a high of 80 inches in the Southern Appalachians. Warm-season precipitation ranges from about 20 inches in southern Michigan to around 34 inches in northern Florida, and annual snowfall ranges from none in Florida to 50 or more inches in the North. Average annual temperature is 70° F. in the South and 45° in the North, while temperature extremes show a high of 115° and a low of -30°. The growing season varies in length from 160 days in southern Michigan to 300 or more days in northern Florida (35, 39).

EDAPHIC

Dogwood occurs on a variety of soils ranging from deep, moist soils along streambanks to well drained, light upland soils (36). Dogwood occurs most frequently on soils of pH 6 to 7 (2, 26). The most important great soil groups included in the range of flowering dogwood are red and yellow podzolic, gray-brown podzolic, brown podzolic, and alluvial soils (6).

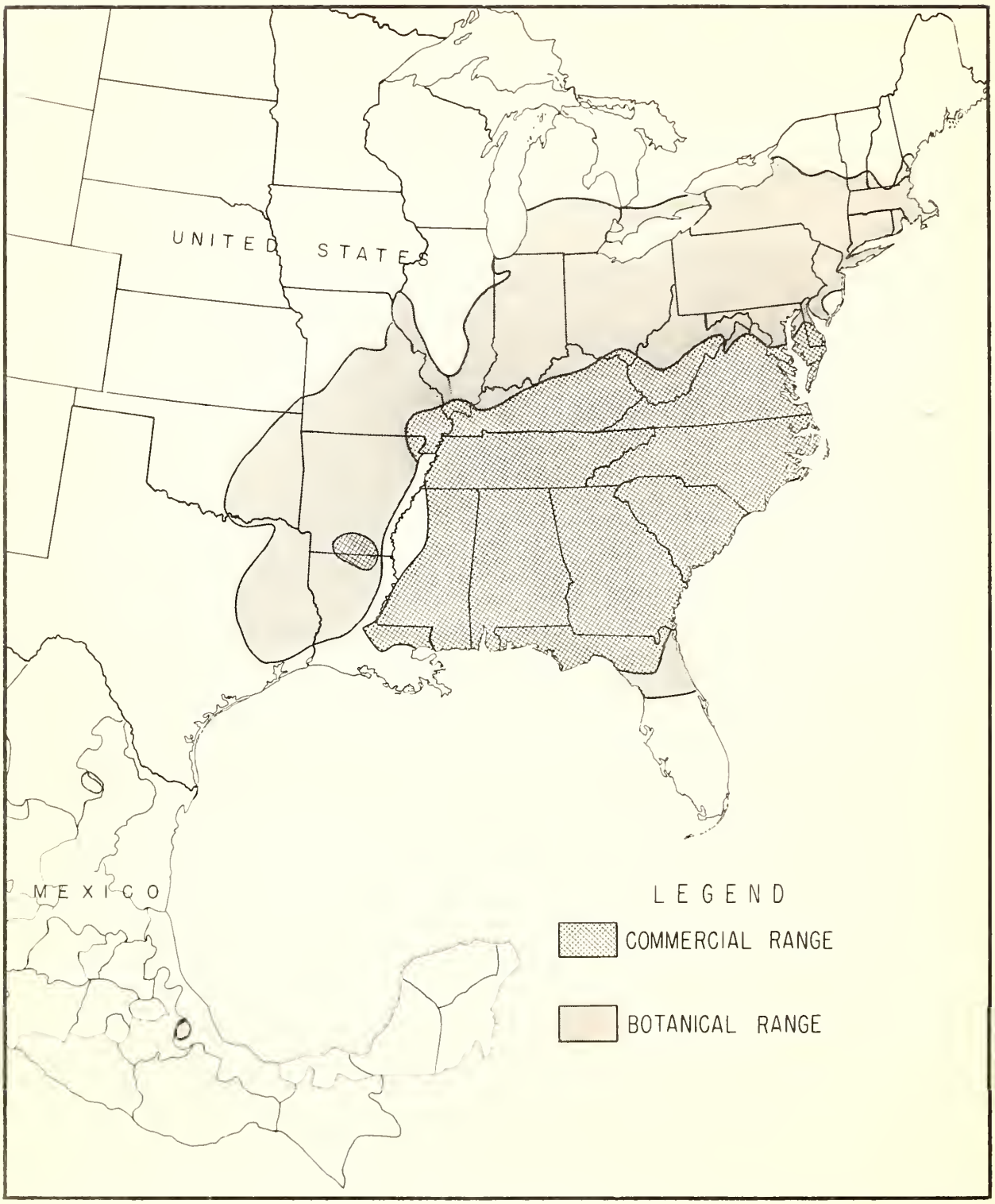

Figure 1.--Botanical and commercial range of flowering dogwood (Cornus florida).

The survival of dogwood seedlings is much lower on heavy soils than on light ones (13). In New England, dogwood occurs mainly on soils of medium water-holding capacity (10). On cutover loblolly pine (Pinus taeda) lands in the Virginia Coastal Plain, it was found that the species was virtually absent on poorly drained, heavy soils. As drainage improved and soils became lighter, the frequency of dogwood in the stand increased. The following tabulation illustrates how the frequency of occurrence of five hardwood species varied with major soil differences (41):

Species	Poorly drained plastic (Percent)	Well drained plastic (Percent)	Well drained friable (Percent)
Sweetgum (Liquidambar styraciflua)	41.5	39.0	26.0
Red maple (Acer rubrum)	43.0	39.0	26.0
Red oaks (Quercus spp.)	12.0	10.0	21.0
Dogwood	0.5	5.0	15.0
Waxmyrtle (Myrica cerifera)	3.0	7.0	12.0
Total	100.0	100.0	100.0

The role of dogwood as a soil improver is of increasing interest. The litter contains 2.0 to 3.5 percent calcium on an ovendry basis (8, 24). By comparison, the litter of black oak (Quercus velutina), sweetgum, shortleaf pine (Pinus echinata), loblolly pine, and white oak (Quercus alba) has only 0.4 to 1.1 percent calcium. In the North Carolina Piedmont the abundance of dogwood in the latter stages of pine succession materially improves soil fertility (8).

In addition to being an important source of calcium, dogwood litter decomposes more rapidly than that of other species, thus making its mineral constituents more readily available (8). It also ranks high in antacid buffering capacity. The decomposition factors for the litter of dogwood and several other species are listed below:

Species	Decomposition factor
Flowering dogwood	92
Hickory (Carya spp.)	31
Yellow-poplar (Liriodendron tulipifera)	19
Eastern redcedar (Juniperus virginiana)	19
White ash (Fraxinus americana)	18
Sycamore (Platanus occidentalis)	9
Northern red oak (Quercus rubra)	8
White and black oaks (Quercus spp.)	7

Decomposition factor = $\frac{N \times Ca \times 10}{H+}$ where N = weight of total nitrogen in the leaf, Ca= weight of total calcium, and H+ = weight of free H+ ions when 5 grams of litter are in equilibrium with 100 ml. of .05 N HC1. This

factor is positively correlated with decomposition under field conditions, although failure to include content of tannins and resinous matter in the equation results in high values for redcedar and the oaks.

PHYSIOGRAPHIC

In the Southern Appalachians, the optimum elevation for dogwood is 1,000 to 4,000 feet (17). It grows well on flats and on lower and middle slopes but not very well on upper slopes or ridges.

On the Piedmont Plateau of North Carolina, dogwood is a characteristic understory tree in upland stands of loblolly pine (24). As these stands progress over into the hardwood climax, dogwood remains an important subordinate species. Dogwood is also one of the most numerous species in the understory of bottomland loblolly pine and hardwood stands.

In southern Kentucky, dogwood is a common tree on broad ridge tops of the Cumberland Plateau escarpment. It occurs frequently on deep, well-drained upland sites in the Ozarks, especially on north and east aspects. In the New Jersey Piedmont, dogwood is an important understory species (4).

BIOTIC

Although flowering dogwood is specifically mentioned in only two forest types, Number 41 scarlet oak, and Number 52 white oak-northern red oak-hickory, it occurs in a number of others, always as a subordinate species. It is found growing throughout most of the eastern United States in association with many other hardwoods and conifers.

The species with which dogwood is associated in types Nos. 41 and 52 are (32):

1. Scarlet oak, No. 41. Scarlet oak (Quercus coccinea) predominates. The associated species are black oak, southern red oak (Quercus falcata), chestnut oak (Quercus prinus), white oak, post oak (Quercus stellata), hickories, pitch pine (Pinus rigida), blackgum (Nyssa sylvatica), sweetgum, black locust (Robinia pseudoacacia), shortleaf pine, and Virginia pine (Pinus virginiana).

2. White oak-northern red oak-hickory, No. 52. The three types species predominate. In southeastern Pennsylvania, associates are yellow-poplar, pignut hickory (Carya glabra), shagbark hickory (Carya ovata), mockernut hickory (Carya tomentosa), white ash, red maple, beech (Fagus grandifolia), and blackgum. This type is found at elevations of 500 to 2,000 feet on upland soils where the moisture supply is reasonably good but not excessive.

Dogwood seed is eaten by many species of birds including various songbirds, ruffed grouse (Bonasa umbellus), bob white quail (Colinus virginianus), and wild turkey (Meleagris gollopavo). It is also attractive to squirrels (Sciurus spp.), chipmunks (Tamius striatus), and cotton tail rabbits (Sylvilagus floridanus) (38). The young shoots are a preferred food of white tail deer (Odocoileus virginianus).

LIFE HISTORY

PHENOLOGY

Average dates for the beginning of flowering, leafing, seed ripening, seedfall, and leaf fall in the northern and southern portions of the dogwood range are as follows (21):

1. Flowering and leafing: April 12 in the South to May 25 in the North.

2. Seed ripening: September 15 in the South to October 15 in the North.

3. Seedfall: October 1 in the South to November 25 in the North.

4. Leaf fall: October 1 in the South to October 30 in the North.

FLOWERING HABITS

The head of the flower bud appears in the summer borne between the upper pair of lateral leaf buds. The involucral scales open early the next spring, forming a showy, flat, corolla-like cup 3 to 4 inches in diameter. The small, perfect flowers are in dense, cymose heads (30). Flowers have been observed on trees of sprout origin which were 6 years old, 3/4 inch in diameter at the stump, and 4 feet tall.

SEEDING HABITS

The bright red, mature fruit of flowering dogwood is ovoid, $\frac{1}{4}$-inch wide and $\frac{1}{2}$-inch long, and crowned with the calyx and style which are both persistent. The fruit has thin, mealy flesh surrounding one or two thick-walled, smooth, slightly grooved seeds (30).

Dogwood produces a good seed crop every 2 years. Seeds produced on isolated trees are frequently hollow, so it is best to make collections from groups of trees. Seed is scattered by gravity, birds, and other animals (37).

VEGETATIVE PROPAGATION

Dogwood is a profuse sprouter. In the Appalachian Mountains of North Carolina, taller, more numerous sprouts were produced following winter fellings than following midsummer fellings (7). In the Coastal Plain of Virginia, height of the sprouts increased with increasing stump diameter, and a 1-inch increase in stump diameter resulted in a 0.3-foot increase in sprout height (41). Epicormic branching is also abundant on this species.[1/]

Dogwood reproduces extensively by layering (24). As much as 100 percent success in the rooting of cuttings can be achieved by treatment with indole 3 butyric acid, indole 3 acetic acid, napthalene acetic acid, or napthalene acetamide (12, 34). Untreated cuttings taken in the spring just at the end of flowering also rooted 100 percent in one study, but failed completely in others. In nursery practice the various clones are commonly propagated by grafting.

SEEDLING DEVELOPMENT

Dogwood seed germinates in the spring after it has lain on the ground over winter. Moist, well-drained, rich loams provide the best seedbed. Nursery germination of the seed ranges from 77 to 85 percent. Freshly gathered seed will not germinate, but germination takes place following moist storage for 100 to 130 days at 0° to 10° C. Seed stored above 15° C. will not germinate (11). Subjecting seed to high hydrostatic pressures will not hasten germination (29). Suggested pretreatment is stratification in sand or peat for 100 to 130 days at 5°C.

Root growth of dogwood seedlings is quite rapid. In one study greenhouse-grown dogwood 6 months old had 3,000 roots with a total length of 168 feet, compared to 800 roots with a total length of 12 feet for loblolly pine (18).

A study of 1-year-old dogwood reproduction in the North Carolina Piedmont showed that soil moisture was the most important factor in seedling survival (13). In another test, also in the North Carolina Piedmont, comparing seedling survival of loblolly pine, shortleaf pine, white oak, and dogwood planted under three different stand conditions (in the open, under pine stands, and on the margin of pine stands), white oak had the best survival in all three locations. The best survival for dogwood was on the stand margin; the best survival for white oak was in the pine stand; and the best survival for the pine was in the open. After four seasons most of the oak and some of the dogwood under the pine stand were still alive but all of the pine seedlings were dead (19).

In a study of 1-0 dogwood seedlings planted in western Tennessee on old field soils of the Susquehanna-Savannah-Ruston group, the first year survival was 80 percent. After the fifth season, however, dogwood survival dropped to 23 percent. Survival was best on north slopes and poorest on south slopes (31).

1/ Doolittle, Warren Truman. Early effects of pruning on the height and diameter growth of sycamore. 56 pp., illus. 1950. (Unpublished M.F. thesis at Duke Univ. School of Forestry.

SAPLING STAGE TO MATURITY

The maximum size for dogwood on good sites is 40 feet tall and 12 to 18 inches d.b.h. (15). Height growth in the Southern Appalachians is fairly rapid the first 20-30 years, but then it practically ceases. Near the northern limits of its range dogwood becomes a many-branched shrub. In western Tennessee, average height of 1-0 seedlings was 2.6 feet 5 years after planting (31). In Jackson County, Florida, it was reported that dogwood reached a breast high diameter of 5 inches in 11 years (1). At Athens, Georgia, the period of rapid diameter growth lasted 80 to 89 days during the growing season; fifty percent of the diameter growth was completed in 40 to 49 days (16).

Minimum merchantable size of dogwood is 4 inches in diameter (inside bark) at the small end of 18-inch bolts. On good sites, yields of 2 cords per acre are possible, but sometimes it takes 15 to 20 acres to grow one cord (5).

Dogwood is very tolerant of shade and is usually found in the understory (3, 24). It reaches maximum photosynthesis at a light intensity of 3,000 foot candles, as does white oak, another tolerant species (20). This ability to carry on maximum photosynthesis at one-third of full sunlight helps to explain why dogwood can survive and grow under a forest canopy.

With such a wide range, dogwood is probably quite tolerant of both high and low temperatures, but it is susceptible to drought. During hot, dry weather dogwood leaves often turn red, curl, and cup. If the drought is prolonged, the leaves may fall and severe dieback of the top follows (23). For example, during a dry spell at Utica, Mississippi, mature dogwood trees were killed.[2/] In north Mississippi dogwood leaves are the first to dry up when a drought begins; on hill sites the drought mortality of dogwood is surpassed only by hickory and overmature blackjack oak. Since it is an understory tree, dogwood receives considerable protection from high winds and glaze storms.

Because of its thin bark, mature dogwood is readily injured by fire (14). In the oak-hickory region, however, this results in an increased proportion of dogwood in the stand because of the profuse sprouting of fire-killed trees. Dogwood is also quite susceptible to flooding. In experiments with potted dogwood seedlings, flooding killed the plants in 1 to 3 weeks (25).

The species is attacked by several insects, most important of which are the dogwood borer (*Thamnosphecia scitula*), the flat headed borers (*Chrysobothris femorata* and *Agrilus cephalicus*), and the dogwood scale (*Chionaspis corni*) (40).

Dogwood is relatively free of disease. Leaf spot (*Cercospora cornicola*) attacks seedlings. Other diseases important mainly on ornamental plantings are (23):

2/ Keppler, William E. Draper Corporation, Asheville, N. C. Personal Interview. December 1956.

1. Basal stem canker, caused by the fungus Phytophthora cactorum, may girdle the tree and is the most common killing disease.

2. Twig blight, caused by the fungus Myxosporium nitidum, sometimes results in dieback of the small twigs.

3. Spotting and dieback of dogwood leaves and flowers is caused by the fungi Botrytis cinerea, and Elsinoe corni. Locally severe shriveling and blackening of the leaves is caused by infections of Ascochyta cornicota, while Septoria cornicola causes less conspicuous leaf spots.

Serious animal injury is uncommon, though dogwood reproduction is often browsed by deer and cottontail rabbits (33).

GENETIC VARIATION

There is no information available on racial variation of dogwood, although with such a wide range racial variation probably exists. Four clones, commonly propagated as ornamentals are (27):

1. Cornus florida f. pendula (Dipp.) Schelle, which has pendulus branches.

2. Cornus florida f. rubra (West.) Schelle, with red or pink involucral bracts.

3. Cornus florida f. pluribracteata Rehder, with 6 to 8 large and several small bracts on the inflorescence.

4. Cornus florida f. xanthocarpa Rehder, which has yellow fruit.

In addition to these clones the Mexican subspecies, Cornus florida subsp. urbiniana (Rose), which Rickett found in the mountains of Nuevo Leon and Vera Cruz, differs from subspecies florida in its greyer twigs and larger drupes. The relative hardiness of the two subspecies is unknown (28).

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